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ABSTRACT

A study aimed at developing an intravenous therapy module for second-year registered nursing students is described in this practicum report. The report's five chapters define the underlying problem and purpose of the study; discuss the history of intravenous therapy and the significance of the module to the host institution; review the relevant literature; describe procedures used to complete the practicum; present the study findings with their implications; and make recommendations for implementing and validating the module. Four appendixes include parenteral infusion guidelines, an outline of critical elements for intravenous therapy, an outline of the individual therapy module, and a schedule and plan for use in presenting the module which includes lists of equipment needed for intravenous therapy labs. The parenteral infusion guidelines list the procedures that are prohibited for students and outline the procedures for setting up and maintaining an infusion. The list of critical elements for intravenous therapy details the steps involved in 12 procedures for setting up, maintaining, and adjusting intravenous infusions. The learning module lists 15 content areas ranging from: identifying common intravenous administration equipment and setting up and maintaining primary and secondary lines and volume-controlled sets to solving math problems related to intravenous credits. Also included in the module are a statement of purpose, time allotment, procedural outlines, lists of student and teacher responsibilities, assignments, testing procedures, and worksheets. (MN)

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DEVELOPMENT OF AN INTRAVENOUS THERAPY MODULE FOR SECOND YEAR REGISTERED NURSING STUDENTS

Curriculum and Program Planning Seminar

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ABSTRACT

DEVELOPMENT OF AN INTRAVENOUS THERAPY MODULE FOR SECOND YEAR REGISTERED NURSING STUDENTS

Marilyn Balint, R.N., M.S.N.

This purpose of this practicum was to develop a formal Intravenous Therapy Module to be utilized by the nursing faculty to teach the principles of intravenous therapy to second year students enrolled in the nursing program at Long Beach City College.

Seven members of the faculty of the Division of Nursing and Health Technologies at Long Beach City College were asked to participate in the study by serving in an advisory capacity during the module development process. Each step in the process of developing the intravenous module was presented to the practicum advisory panel who were asked to review the materials. The materials were then revised in accordance with the advisory panel's recommendations. The revised materials were then presented to the advisory panel for their approval. The process was continued until the materials were approved as presented.

Intravenous therapy was found to be a complex and demanding subject requiring the mastery of many skills. The content of the module was determined based on the review of the literature and input from the advisory panel. The module was designed to flow from simple to

complex with one set of procedures reinforcing the last. Sufficient time was provided for each student to perform the required procedures while being supervised by a teacher. Critical elements were written to provide the standard against which the student's competence would be measured during skills testing. The labs were spaced over a five week period to allow the student time to assimilate the materials.

It was recommended that the Intravenous Therapy Module be utilized to teach infusion techniques to the second year nursing students in the fall of 1988 at Long Beach City College; that the module be validated by comparing the success rate on the intravenous therapy skills assessment of students who have not taken the module and students who have completed the module; and, that faculty and students be encouraged to evaluate the module to determine if it is meeting the expectations. It was also recommended that the feasibility of developing a videocassette program specific to teaching intravenous therapy in the nursing program at Long Beach City College be investigated.

TABLE OF CONTENTS

Page

ABSTRACT..... ii

LIST OF TABLES..... vi

Chapter

1. INTRODUCTION..... 1

Underlying Problem..... 1

Purpose of the Study..... 2

2. BACKGROUND AND SIGNIFICANCE..... 3

Background..... 3

Significance to the Institution..... 5

Relationship to the Seminar..... 5

Review of the Literature..... 5

3. PROCEDURES..... 24

Definition of Terms..... 28

4. FINDINGS..... 30

5. DISCUSSION, IMPLICATIONS, AND RECOMMENDATIONS..... 44

Discussion..... 44

Implications..... 48

Recommendations..... 49

BIBLIOGRAPHY..... 51

APPENDICES

A. PARENTERAL INFUSION GUIDELINES..... 54

B. CRITICAL ELEMENTS FOR INTRAVENOUS THERAPY..... 57

C. INTRAVENOUS THERAPY MODULE..... 60

D. SCHEDULE, PLAN AND EQUIPMENT NEEDED
FOR LABS THE INTRAVENOUS THERAPY LABS..... 70

LIST OF TABLES

Table		Page
1.	LIST OF CONTENT FOR THE INTRAVENOUS THERAPY MODULE BASED ON THE REVIEW OF THE LITERATURE	34
2.	CONTENT DELETED FROM THE INTRAVENOUS THERAPY MODULE BY THE ADVISORY PANEL	37
3.	CONTENT FOR THE INTRAVENOUS THERAPY MODULE	38
4.	FOCUS OF LAB CONTENT WITHIN THE SIX LAB PERIODS IN TRANSITION	40

Chapter 1

INTRODUCTION

Underlying Problem

The faculty at Long Beach City College has long been aware that intravenous (IV) therapy must be taught to the nursing students in the associate degree nursing program. How the subject should be taught has not been so clear. Over the years, aspects of intravenous therapy have been included in several courses in the nursing program. During the last five years the heaviest concentration of this content was in a course called Transition. The intravenous therapy content in this course and in other courses in the program grew out of the need recognized by the faculty, but had not been formalized.

Transition is a six-week course taught at the beginning of the second year of the registered nursing program. While testing of previously learned skills is a part of the course, the focus of the new skills taught in Transition center around intravenous therapy. It is in this course that the student is expected to learn how to monitor intravenous therapy including how to set up administration sets, add solutions to new and existing set-ups, identify primary and secondary intravenous lines,

add medications to primary and secondary lines, and monitor the patient's progress during fluid administration. The faculty has become aware that intravenous therapy is a complex subject requiring very specific knowledge and skill as well as supervised practice time for the learner to master to subject. They have expressed a need for an organized module to teach intravenous therapy in the program.

A recent college decision to eliminate the summer session of the registered nursing program necessitated a major curriculum change in which the content of each course was examined and revised to make up for the loss of the six-week summer session. The intravenous therapy module was designed to fit within the framework of the new Transition Course structure.

Purpose of the Study

The purpose of this practicum was to develop a formal Intravenous Therapy Module to be utilized by the nursing faculty to teach the principles of intravenous therapy to second year registered nursing students enrolled in Transition at Long Beach City College. Provisions to validate the Intravenous Therapy Module are discussed in the final chapter of the practicum.

Chapter 2

BACKGROUND AND SIGNIFICANCE

Background

Intravenous therapy, the administration of fluids, medications and/or blood and blood products by way of the venous system, is an integral part of the daily care of the hospitalized patient. Intravenous therapy is frequently regarded as a lifesaving procedure, but safe and successful therapy is essential and demands special knowledge and skill. "There is no margin for error in infusions since the fluid and medication are directly introduced into the bloodstream and their effects are immediate (Billings and Stokes, 1982:252)."

Historically, intravenous therapy was performed by the physician and was considered a "medical act." After 1940, the scope of nursing increased and nursing practice was redefined to include responsibilities such as intravenous therapy. California law now clearly defines the registered nurse's responsibility regarding the administration of intravenous fluids, including medications and blood (Nurse Practice Act, 1986). Efforts to further define nursing practice have been made by the American Medical Association in joint policy statements issued with state nursing associations identifying the

responsibilities of the nurse in carrying out procedures such as intravenous therapy.

"Once reserved for the most critically ill, intravenous therapy is now part of treatment for a quarter of all hospitalized patients, an estimated eight million people a year (Aisenstein, 1981:38)." These patients receive blood, fluids and electrolytes, total parenteral nutrition, and a variety of drugs by the intravenous route. The registered nurse is responsible for the safety of these patients during intravenous administrations.

Although venipuncture, the initiating of intravenous therapy, is commonly taught to the new employee by the inservice department of the hiring agency, new graduates are expected to be proficient in all other aspects of intravenous therapy.

Prohibitive medical costs are forcing the patient out of the hospital prematurely and the locus of health care is shifting from the hospital to the community and home. The use of home infusion therapies is on the upswing. According to the editors of Nursing and Health Care (1986:19), "a 191 percent increase in the number of intravenous feeding patients undergoing treatment at home is predicted by industry analysts and we must be prepared to meet this need."

Significance to the Institution

The Intravenous Therapy Module will be used in the Transition Course at Long Beach City College in the second year of the registered nursing program. The competency-based module will clarify the boundaries of the subject as delineated by members of the nursing faculty, as well as simplify the teaching and testing of intravenous therapy by the use of critical elements. Suggestions for procedures to validate the Intravenous Therapy Module are discussed in the Findings chapter of this practicum.

Relationship to the Seminar

In developing the Intravenous Therapy Module, the principles of curriculum design were utilized thus providing the investigator with a practical application of the theory learned in the Curriculum and Program Planning Seminar.

Review of the Literature

The objectives of the search of the literature were to: 1) determine the course structure and critical skills, concepts and theories of intravenous therapy to be included in the module; 2) determine the most current

procedures recognized for the safe and effective administration of intravenous products; 3) identify products currently being used in the clinical agencies; 4) determine which products were cost-effective for utilization as practice materials for the clinical labs; and, 5) determine the type of audiovisual materials most adaptable to teaching intravenous therapy.

According to Gagne and Briggs (1979:45), "the best way to design instruction is to work backwards from its expected outcomes." The search of the literature revealed several models for courses in intravenous therapy and related topics which were examined for content and structure and for insight into the expected outcomes for the Intravenous Therapy Module.

Galliart (1984) proposed that the curriculum related to teaching the equipment and skills required for nursing care of patients needing intravenous therapy should include coverage of the roles and responsibilities of the nurse; anatomy and physiology of the circulatory system and skin; considerations for IV therapy; preparation and assessment for IV therapy; solutions and containers; equipment and supplies; accessory equipment; venipuncture process; problems and complications; monitoring and maintenance of the IV; medications; blood, blood products, and volume expanders; special catheters; parenteral nutrition; and pediatric IV therapy.

In order to be complete, according to Reyes (1984), a course in intravenous therapy should include the history of IV Therapy; legal aspects; psychological preparation of the patient; fluid and electrolyte balance, basic solutions, drug interactions; total parenteral nutrition; central lines; basic equipment-tubings, needles, cannulas, accessories, bottles and bags, controllers, pumps; calculation of flow rates; anatomy and physiology of veins and arteries; complications of IV therapy; blood and blood components, ABO - Rh blood compatibilities, transfusion reactions and the nursing implications; trouble shooting IV's; prepping and insertion techniques; and, taping methods.

When Herrscher (1984:3) discussed competency-based education, he stated that

> competency-based education is an educational framework which systematically focuses on student attainment of a hierarchy of publicly stated and validated intellectual, attitudinal, and/or motor learning outcomes and the concomitant instructional processes that facilitate, measure, and certify such attainment.

The three distinct components of competency based education are objectives, learning activities, and evaluation. The focus must be on student learning, not on teacher activity. Behavioral objectives must be highly specific at the module or course level, they must be written and shared with the student and the validation process should be systematic. Criterion-referenced

testing that involves comparing student performance with a pre-set standard is basic to competency-based education. Therefore, student progress should be assessed through use of criterion-referenced measures (Herrscher, 1984).

Lombardo (1984) designed a competency-based course, including intravenous therapy, to update the skills and knowledge of inactive nurses desiring to return to active practice. Each module of the course contains an overview, a student competency sheet, performance objectives, learning activities, an evaluation, enrichment activities, student worksheets, and a teacher's guide with answers to student worksheets.

Hegstad and Zsohar (1986) designed an instructional program expressly to produce student attainment of the instructional objectives. The materials included in this instructional program are an instructor's guide, a task-by-task description of the procedures, a checklist summarizing each step, a 10 minute color instructional videotape, and a live demonstration of the process.

Further review of the literature provided insight into specific critical skills, concepts and theories of intravenous therapy to be included in the module.

Juliani (1981) stated that precautions are essential in dealing with even the most common intravenous solutions. For example, normal saline does not distribute

itself within the body's fluid compartments, but rather, stays in the extracellular space mostly in the plasma. "In a patient with renal insufficiency and a slight fluid overload before IV treatment, an infusion of as little as 400 cc's of normal saline in an hour can be excessive, precipitating congestive heart failure (Juliani, 1981:68)."

Alertness to the clinical indications and precautions for every IV solution infused are required. Almost every seriously ill patient develops some disturbance of fluid and electrolyte balance. The nurse's prompt intervention may prevent the imbalance from becoming serious (Juliani, 1981).

"Improper regulation of the flow rate may lead to speed shock and fluid overload, two potentially disastrous complication (Aisenstein, 1981:41)." Too-rapid infusion of a drug into the circulatory system results in speed shock, a condition that can lead to syncope and cardiac arrest. Fluid overload occurs when too large a volume of fluid infuses into the circulation, raising central venous pressure and possibly causing cardiac dilatation and pulmonary edema. Both speed shock and fluid overload can be prevented by using the proper tubing, carefully adjusting the flow-rate valve, and checking it frequently for accuracy. Macro-drip tubing should never be used with elderly or pediatric patients whose circulatory systems

may be especially sensitive to overload. (Aisenstein, 1981).

"A catheter that moves around in the vein may dangerously disrupt the flow of IV solutions (Aisenstein, 1981:40)." As the catheter moves back and forth it may increase the flow rate to dangerous levels. Or, it may lodge against the vein wall and "clot off", stopping the infusion altogether. These so-called positional IVs may result from the location of the catheter or from the condition of the vein (Aisenstein, 1981).

Recently, giving antibiotics intravenously has become a major nursing responsibility. There is a staggering number of antibiotics on the market and each requires a specific reconstitution diluent, dose dilution, and administration rate. Adverse side effects from the medications themselves and from their IV administration are not uncommon so it is important that the nurse be aware of the pertinent data on each drug (Stiklorius, 1981).

Arwood and others (1984) contend that the effect of intravenous tubing lumen diameter on accurate fluid and drug delivery is a very important concept. Cohen (1982) stated that accurate administration of intravenous fluids by way of an infusion controller, one type of intravenous infusion machine, is dependent on the use of the correct

size tubing further emphasizing the importance of teaching this information.

Many references dealt with problems associated with intravenous therapy and the current procedures which are recognized as safe and efficient. IVs are potentially hazardous, and major - often preventable - complications occur with regretable frequency (Aisenstein, 1981).

"IVs that clot off don't always pose a serious threat to the patient, but they do cause the unnecessary discomfort of repeated restarts (Aisenstein, 1981:38)." A slow or absent flow rate or improper placement of the solution bottle can cause clotting because blood backs up into the catheter and tubing. Ideally, IV bottles should hang at least 30 inches above the patient's heart level to promote flow by gravity. When intermittent IV use is ordered, it's safer and more convenient to use a heparin lock than a continuous slow flow rate to keep the IV open (Aisenstein, 1981).

Once the intravenous line has "clotted off" it is common practice to irrigate it to re-establish the flow. The irrigation of a clotted IV line may cause pulmonary embolism since the flow of blood from peripheral veins circulates through the venous system to the vascular bed of the lungs. The destination of clotted material once it has been flushed into the vascular system is dependent on a number of factors. Among these factors are the size of

the clot, the amount of pressure used to expel the clot, and the friability of the clot at the time of expulsion. McFarland (1983:46) pointed out

> there is no research to date that explores definitive statements about the destination of a clot in relation to these factors. However, since the possible hazards outweigh the benefits of such a procedure, clotted IV lines should not be irrigated until there is evidence that the procedure is not harmful to the patient.

Common problems with IV lines include separation in the patient's intravenous catheter tubing, occlusion of the line and flow rate problems. Masoori (1983) offered solutions for these common problems which indicate the need for further research. If a catheter becomes separated the risks of contamination by rejoining the tubing must be weighed against the risks of allowing air to enter the line. In the instance of a central line, this could result in a fatal air embolus. The author does not clearly identify the correct procedure to be followed if the line is peripheral and the predominant danger is contamination.

Intravenous dressings are addressed by Freeman and Boyer (1982). Traditional dressings have to be changed every 24 to 48 hours so that the site can be cleaned and inspected. Changing the dressing requires manipulation of the cannula and that, in itself, often increases the risk of infection and infiltration.

The procedures adopted for giving intravenous medications must help reduce two common risks of IV antibiotics: contamination and vein irritation. Stiklorius (1981) suggests that, whenever feasible, bacteriostatic water should be used for injection rather than the sterile water since bacteriostatic water contains .9% benzyl alcohol to provide extra protection against contamination.

Vein irritation can be reduced by using the greatest dose dilutions and slowest infusion rates that can be used without compromising the drug's efficacy. Intermittent infusion with a small-volume IV bottle or a volume-control set (Solu-Set, Buretrol) is the safest method. IV bolus infusions may cause sclerosing and pain and continuous IV infusions result in loss of drug potency (Stiklorius, 1981).

"More than one of every eight patients who received IV therapy recently suffered infusion phlebitis or inflammation of the cannulated vein (Aisenstein, 1981:38)." This potentially serious complication includes pain and venous sclerosis and the effects can linger long after the patient is discharged from the hospital. The author identified important actions that can be taken to decrease the occurence of phlebitis.

Large-bore needles and catheters increase the incidence of phlebitis and should be used only when

necessary. The more the catheter moves within the vein, the greater the chances of mechanical phlebitis and other problems. Antibiotics should be given in diluted form since undiluted antibiotics are very irritating to vein tissues. According to the author, an intravenous line should remain in place for no more than 48 to 72 hours. After this time, a fibrin sheath that can harbor bacteria surrounds the tip of the catheter. Frequent assessment of the intravenous site is necessary to catch the first sign of phlebitis which, if not treated can cause permanent damage (Aisenstein, 1981).

"Infiltration, the escape of IV fluids into the surrounding tissue, can cause tissue damage and necrosis severe enough to require reconstructive surgery (Aisenstein, 1981:39)." Fluid escapes into the tissue when a catheter or needle penetrates the wall of the vein. Edema may be pronounced and painful. If the solution contains a drug toxic to subcutaneous tissue it can destroy the tissue. An infiltrated IV also prevents the patient from receiving the IV solution at the rate ordered by the physician. Symptoms of infiltration include swelling and pain at the IV site as well as disruption of the infusion. The skin over the swelling may feel cooler than the surrounding skin when the solution being administered is cooler than body temperature (Aisenstein, 1981).

When assessing for possible infiltration, compare the IV site with the opposite extremity for changes in appearance, diameter, and temperature. Check for blood return by placing a tourniquet proximal to the IV site and then checking to see if the infusion stops. If it continues after the tourniquet is in place, the IV is probably infiltrated. Prevent infiltration by keeping IVs away from joints, by limiting movement of the extremity, and by using the smallest possible needle or catheter in the largest available vein (Aisenstein, 1981).

Infection is a common complication of intravenous therapy because the catheter acts as a conduit that can introduce pathogenic organisms directly into the blood stream. Failure to recognize and treat infection promptly can lead to development of septic phlebitis. The infected vein becomes saturated with pus, discharging massive numbers of microorganisms into the blood stream (Aisenstein, 1981).

A few simple rules will help protect the patient from the dangers of infection during intravenous therapy. These include: frequent and thorough hand washing to prevent cross-contamination; examining the contents of the solution bottle to see that it is clear with no particulate matter; and, changing dressings and tubings regularly. Wet or soiled dressings on an IV site provide a dark, moist, warm environment, the perfect medium for

bacterial growth. Controllers and pumps when used must be kept clean. The machines are usually close enough to the IV site to pose a potential contamination hazard if dust and dirt are allowed to collect. Reduce the risk of infection by wiping the machine daily with alcohol or disinfectant (Aisenstein, 1981).

Because of their low body weight and small size, infants are exceptionally vulnerable to complications during intravenous therapy. Even minimal infiltration of fluid into the surrounding skin can cause extensive necrosis in the area. Fluctuations in flow rate are also potentially serious since they can result in erratic blood glucose levels or overhydration. Air can be fatal when introduced into an infant's bloodstream, and perforation of the vein from sudden movements by the infant may dislodge the needle causing massive infiltration (Oelerich and Dombrowski, 1981).

Oelerich and Dombrowski (1981:45) suggested regulating the flow rate when the infant is at rest, because crying "might constrict the vessels, resulting in a too-rapid rate when the crying stops." The fluid rate and the child's reaction should be checked at least every hour. The authors warned that placing more than one-third of the daily ordered intravenous volume in the chamber at any one time is highly dangerous. Early signs of infiltration must be identified since many infusion

control pumps will continue to infuse fluid at the preset rate for a while after infiltration has begun (Oelerich and Dombrowski, 1981).

The nurse must be aware of the type and effects of of intravenous therapy machinery being used, including the limitations of such machinery. The two most commonly utilized machines, the volumetric gravity-dependent rate controller and the non-volumetric (drop-counting) gravity-dependent controller are compared providing insight into the function of both. (Cohen, 1982).

Huey (1983) stated that infusion regulating machines, when used, are usually mounted on IV poles with the pump at eye level and a controller at least 36 inches above the IV site. "Since a pump is not supposed to depend on gravity pressure, it can be placed at any level. A controller overcomes venous resistance when placed 36 inches above the site, providing about 1.3 psi gravity pressure (Huey, 1983:1026)."

Aisenstein (1981:40) warned that controllers and pumps can never take the place of good nursing care and judgment. "A swinging solution bottle, kinked tubing, a moving catheter, a mechanical problem, or a host of other variables can all affect the flow rate regardless of the machine setting."

McGuire and Wright (1984) expounded on the use of pumps to administer continuous narcotic infusions (CNI) to

patients suffering severe and debilitating pain. Once used only in the final stages of cancer and after all other efforts have failed, continuous narcotic infusions are now being administered to patients suffering severe burns, acute pancreatitis, fistulas, and Crohn's disease as well as acute postoperative pain. In all these instances CNI provides safe and effective pain control until the condition causing the pain can be resolved. The importance of understanding infusion pumps cannot be emphasized too much, especially in a situation where the drug being administered is a potent narcotic which could stop the patient's respiratory system or heart in high concentrations.

"Every time you start an IV infusion of an antibiotic, you automatically expose your patient to a wide range of side effects (Newton, 1981:44)." And though they are essentially the same adverse effects seen with oral administration, the suddenness of absorption and the higher blood levels achieved via the parenteral route usually intensify the reactions and hence the risks. The patient is at risk for everything from a local rash to a severe anaphylactic reaction (Newton, 1981).

Before administering the antibiotic, check the package's expiration date and the directions for reconstitution, dilution and storage. Find out if the patient has suffered reactions in the past. Maintain the

proper drug level. Monitor blood work to determine blood level and toxicity to the liver or kidneys. Keep resuscitation equipment and 1:1000 epinephrine on hand in case of an anaphylactic reaction (Newton, 1981).

Several studies identify the importance of knowing which medications and solutions are chemically altered by the use of glass and/or polyvinyl chloride intravenous administration sets.

Hans and others (1982) found that the use of a glass container and a polyvinyl chloride (PVC) tubing resulted in a rapid and significant decrease in the concentration of the medication nitroglycerine when administered intravenously. Cossum and Roberts (1981) found that the use of plastic infusion bags and/or plastic administration sets resulted in a significant loss of several medications and necessitated the use of a special set-up using a glass syringe and high density polyethylene tubing for the administration of these drugs. Reed, O'Banion and Pennington (1982) reported similar problems with heparin administration in plastic IV bags. Although plastic bags and polyvinyl chloride tubings are used in most of the clinical agencies, it must be pointed out that dangers exist when administering drugs by way of these administration sets.

According to Bing and O'Donnell (1984), the patient who requires treatment in intensive care has

special needs during intravenous therapy. Problems occur when a critically ill patient's fluid intake is restricted, yet he needs continuous intravenous medication. Often venous access sites are limited so an attempt is made to combine medications in the same line. Combining two incompatible drugs in an IV line could cause a precipitate to form in the line, which could lead to infusion phlebitis. The combination of drug could also alter the chemical structure of one of the drugs, affecting its potency or bioavailability.

The literature was filled with examples of the many brands of intravenous equipment available and in use in American hospitals. Products currently being used in the clinical agencies include Abbott, Travenol, and Cutter intravenous solutions in both bags and bottles; Abbott, Travenol and Cutter primary and secondary lines and extension tubings; Imed, Ivac and Life Care pumps and controllers; and, all of the standard needles, cannulas and tubings. Intravenous medications are administered in a variety of ways including short secondary lines and primary lines both in front of and behind the machinery being used. The student is likely to encounter all of the above equipment while completing the nursing program.

The literature contains many references describing various intravenous infusion machines. In addition to automatically regulating the IV flow rate, infusion

machines can alert the nurse to such problems as irregular flow rate, air or other obstructions in the line, and empty containers. "The two most important rules of thumb to remember are to choose the least complicated device available for your patient's needs and to thoroughly learn how to use it (Woodland, 1981:58)."

The simplest type of infusion machine is the controller. It automatically regulates the infusion rate by gravity, usually by means of an electronic drop counter. When positive pressure or a more accurate infusion rate is required, a pump-activated device should be used. These deliver the IV solution by forcing it through the tubing and into the vessel at a given pressure which is measured in pounds per square inch. Like any mechanical device, infusion machines are only as good as the individuals using them (Woodland, 1981).

Wittig and Semmler-Bertanzi (1983) advocated a system they developed to assist nurses to determine whether an intravenous infusion pump or a controller would be best used in certain situations. The system takes into account the need for pressure; rate-consistency or volumetric accuracy; the infiltration risk; and, desired rate. Huey (1983) elaborated on the setting up and troubleshooting of intravenous infusion machinery.

"Skyrocketing health care costs have given rise to allegations that many hospitalizations and much treatment

are unnecessary - and thus have created a major concern for evaluation in all aspects of health care (Griffith and Megel, 1981:670)." This concern is felt in nursing education. The authors explored a method of preparing nursing students to understand the factors influencing the provision of quality nursing care, to use standards to evaluate nursing care, and to begin planning changes to improve it. Intravenous therapy is a very expensive part of the patient's health care and the student should be taught appropriate use of administration equipment.

Hegstad and Zsohar (1986:9) admitted that "providing psychomotor practice as a part of an instructional program is often costly in terms of both learner time and instructional material." They propose that instructional designers must take into account both the costs and the probable effects of the practice in making decisions about the inclusion of such practice in an instructional program. "Student nurses cannot be provided with repeated practice of the psychomotor skills on live subjects, because it is impractical and unsafe (Hegstad and Zsohar, 1986:10)."

Learning is often facilitated by the use of a variety of teaching methods. Many references were found to support the lecture method supplemented with a self-paced audio-visual program. Rehn (1985) found a filmstrip program to be superior to the lecture method for

instruction in intravenous therapy. Cohen (1981) reported that tutored videotaped instruction is beneficial for specialized topics. Sox (1984) recommended a technique for specialized topics using a videotaped lecture that can be interrupted for discussion or questions. The method showed similar academic achievement as traditional lecture methods but rated higher with students, increasing participation.

It is evident by the extensive data found in the literature that intravenous therapy is a complex subject and that it is of major importance in nursing practice. The need for a module to teach intravenous techniques to nursing students is supported by the literature. Guidelines for course structure and critical skills, concepts and theories of intravenous therapy are clearly identified. Current procedures recognized for the safe and effective administration of intravenous products are also identified in the literature, making it evident that frequent updating of intravenous techniques must be a requirement for the practitioner. It was not so clear which products would be cost effective for utilization as practice materials in the laboratory setting but the need for repeated practice of psychomotor skills was supported. The literature also supported the benefits of using a combination of teaching methods such as a self-paced videotaped program to augment class presentations.

Chapter 3

PROCEDURES

The purpose of the study was to develop a formal Intravenous Therapy Module to be utilized by the faculty to teach the principles of intravenous therapy to second year students enrolled in the registered nursing program at Long Beach City College.

A detailed explanation of the procedures that were used for completion of this practicum is given in the following pages.

A review of the literature was made to: determine the course structure, critical skills, concepts and theories of intravenous therapy to be included in the module; determine current procedures recognized for the safe and effective administration of intravenous products; determine the effectiveness of providing psychomotor practice for skill attainment; and, determine the type of audiovisual materials most adaptable to teaching intravenous therapy.

The format of the module was to follow that of other modules in the registered nursing program. The module would contain critical elements, procedures, lecture/demonstration sessions, supervised practice sessions and skill testing according to critical elements.

Seven members of the Division of Nursing and Health Technologies at Long Beach City College were asked to participate in the study by serving in an advisory capacity during the module development process. Of the teachers asked to participate in the study, two regularly teach in the first year, and four regularly teach in the second year of the registered nursing program. Learning experiences are presented from the simple to the complex in the nursing program at Long Beach City College and some aspects of intravenous therapy are taught in the first year. It was, therefore, important that both years of the program were represented to prevent repetition of materials and to follow the pattern of moving the student from the simple to the complex.

Both of the first year teachers who served on the practicum advisory panel are directly involved with teaching intravenous therapy content. Both have also taught in the second year of the program in the recent past. Of the four second year teachers, three regularly teach Transition and all four regularly teach in the courses that follow Transition. This provides them with a first-hand understanding of the strengths and limitations of the students in regard to the skills involved with intravenous therapy. Each of these four teachers has also taught in the first year of the program.

The seventh person who was asked to serve on the advisory panel is the Program Director for the Vocational Nursing Program. Her input was requested because it was conceivable that aspects of the module would be useful to the vocational nursing program.

Information was also gathered through informal contacts with other members of the faculty and through student evaluations of previous Transition courses.

The Program Director of the registered nursing program was not included on the advisory panel because at the time of the practicum the Associate Dean was in the process of appointing a new director. It was felt that assuming the responsibilities of a new position would preclude her participation on such a panel.

The first act of the advisory panel was to approve the statement of purpose for the Intravenous Therapy Module.

The Parenteral Infusion Guidelines, department guidelines under which the associate degree nursing student at Long Beach City College practices parenteral infusion therapy, were presented to the practicum advisory panel. The guidelines were rewritten based on input from the panel and a second draft was presented for their approval. The guidelines were accepted as revised.

A tentative outline for the intravenous therapy module was prepared from the review of the literature and

the identification of previously taught materials. The members of the practicum advisory panel were asked to review the outline. The outline was revised in accordance with the advisory panel's recommendations. The final draft of the module outline was presented to the advisory panel and was approved.

The approved content was then arranged into the five lab periods available in the Transition course and presented to the advisory panel for their approval. Although Transition is a six week course, the first lab is used for the testing of previously learned skills and is not available for teaching new skill content. Once the arrangement of the content within the available lab periods was approved, work was begun on designing each lab. The critical elements, procedures, student responsibilities, teacher responsibilities, assignments and the method by which testing would occur were developed and submitted to the advisory panel for approval. The content for the five lab periods was revised to incorporate the suggestions of the panel and was, once again, presented to the advisory panel and approved.

The assessment for achievement of intravenous therapy skills was drafted and presented to the advisory panel. The skills test was approved after a second draft was presented to the panel incorporating their input.

The final copy of the Intravenous Therapy Module was approved and included in the Syllabus for Transition to be taught in the fall semester.

This practicum includes a discussion of the process involved in the development of the curriculum for the Intravenous Therapy Module. The actual module is contained in the Appendices.

Definition of Terms

The following terms are used in this practicum:

Long Beach City College. A California community college that offers open access to low cost, comprehensive, instructional programs in higher education that are responsive to the diverse needs of the community

Registered Nursing Program. A two-year program of instruction culminating in an Associate Degree in nursing. The program prepares graduates to take the National Council Licensure Examination.

Course. A six week, self-contained unit of instruction.

Module. A unit of instruction within a course. In the case of this practicum, a self-contained intravenous therapy module.

Transition. A six week course in the registered nursing program at Long Beach City College. The course in which the Intravenous Therapy Module will be taught.

Parenteral Infusion Guidelines. Department guidelines under which the associate degree nursing student at Long Beach City College practices parenteral infusion therapy.

Primary intravenous line. An intravenous line that is directly attached to the needle in the patient.

Secondary intravenous line. An intravenous line that is piggybacked into the primary line.

Critical Elements. Single, discrete, observable, and mandatory behaviors that collectively comprise the standard against which an individual's competence is measured when performing a skill.

Chapter 4

FINDINGS

The incidence of intravenous therapy has increased to include approximately a quarter of all hospitalized patients (Aisenstein, 1981). In addition, a 191 percent increase in the number of patients receiving intravenous therapy in their home is expected in the very near future (Nursing and Health Care, 1986).

The review of the literature indicates that knowledge and skill in providing safe and effective intravenous therapy for the hospitalized and non-hospitalized patient is the responsibility of the registered nurse (Billings and Stokes, 1982; Nurse Practice Act, 1986). Standards for competent nursing practice clearly state that the nurse shall "perform skills essential to the kind of nursing action to be taken. . . (BRN Report, 1987:7)." Failure of the nurse to provide skilled intravenous therapy to a patient would be considered incompetence.

The statement of purpose for the Intravenous Therapy Module was approved by the practicum advisory panel as follows: After completion of the Intravenous Therapy Module, the student will provide safe and effective infusion therapy to hospitalized patients under the direct supervision of a registered nurse.

The student practices infusion therapy under the guidelines of the Registered Nursing Department at Long Beach City College. The Guidelines for Parenteral Infusion Therapy were revised according to input from the practicum advisory panel and accepted as revised (Appendix A).

According to the literature, in addition to knowing how to set up and maintain a wide range of intravenous therapy equipment, the nurse must have knowledge of the effects of the different intravenous solutions on the human body (Juliani, 1981). The nurse must be able to assess fluid overload and deficit in the patient receiving intravenous therapy (Juliani, 1981; Oelerich and Dombrowski, 1981). The nurse must have the skill to mechanically regulate the flow (Aisenstein, 1981; Masoori, 1983; Oelerich and Dombrowski, 1981) and to recognize the effect of needle lumin size on drip rate and delivery of intravenous solutions (Arwood, 1984; Cohen, 1982). The nurse must know how to safely dress the intravenous site (Freeman and Boyer, 1982). In addition, the nurse must be knowledgeable and skillful in the safe administration of medications by the intravenous route (Stiklorius, 1981; Newton, 1981).

The literature indicated that the nurse must have the ability to recognize and treat the problems of intravenous therapy such as infiltration and phlebitis

(Freeman and Boyer, 1982; Stiklorius, 1981; Aisenstein, 1981; Oelerich and Dombrowski, 1981); separation, contamination, and occlusion (Masoori, 1983). The nurse must know how to deal with the "positional" intravenous that infuses erratically because of the location of the needle in the patient (Aisenstein, 1981). The nurse must be aware of the dangers inherent in the treatment of each of the above problems (McFarland, 1983)

It is apparent from the review of the literature that the nurse must be aware of the wide variety of specialized intravenous equipment in use such as the small volume IV bottle or bag for use with a secondary line to administer medications and the volume-control (Solu-Set, Buretrol) administration sets (Stiklorius, 1981; Oelerich and Dombrowski, 1981). The nurse must know the different needle types and sizes and catheter types and sizes available and their use in different situations (Aisenstein, 1981). The nurse must know what a heparin lock is and when its use is appropriate (Aisenstein, 1981). The nurse must know the similarities and differences among the types and brands of infusion machinery available if these machines are to be used safely (Cohen, 1982; Huey, 1983; Aisenstein, 1981; McGuire and Wright, 1984; Woodland, 1981; Wittig and Semmler-Bertanze, 1983).

The widespread use of plastic and glass container; and polyvinyl chloride administration sets requires that the nurse have knowledge of the effect of these materials on medications and solutions (Hans, 1982; Cossum and Roberts, 1981; Reed, O'Banion and Pennington, 1982).

The pediatric patient (Oelerich and Dombrowski, 1981) and the intensive care patient (Bing and O'Donnell, 1984) have special intravenous therapy needs that require specialized knowledge and skill to deliver competent nursing care.

Based on the review of the literature and operating within the "Parenteral Infusion Guidelines" a tentative list of content for the Intravenous Therapy Module was prepared and presented to the advisory panel. The outline included: fluids and electrolytes including assessment of fluid volume deficit and fluid overload; identifying common equipment used with intravenous therapy; setting up and maintaining primary and secondary lines; setting up volume-controlled sets (Solu-Set, Buretrol); adding medications to bottles and bags; administering medications by way of a secondary line; labeling bottles, bags and volume-controlled administration sets to show medication added; marking intravenous bottles and bags to show the amount to be delivered per hour; regulating the rate and the effect of needle lumen size on rate; making a piggyback connection;

dressing an intravenous site; discontinuing an intravenous; correcting common problems with intravenous therapy equipment; comparing and contrasting infusion machinery; dealing with problems at the infusion site such as infiltration, phlebitis, separation, contamination, occlusion and the positional intravenous needle; working with the patient who has multiple intravenous lines; intravenous lines in the pediatric patient; intravenous lines in the critically ill patient; and, the effects of polyvinyl chloride administration sets on medications.

Table 1 shows the proposed list of content for the Intravenous Therapy Module based on the review of the literature.

Table 1

List of Content for the Intravenous Therapy Module Based On The Review of the Literature

Proposed Content
Fluid and electrolytes
Identifying common IV administration equipment
Setting up and maintaining primary and secondary lines
Setting up and maintaining volume-controlled sets
Adding medications to bottles and bags
Administering medications by way of a secondary line
Labeling bottles, bags and volume-controlled sets

Table 1 (Continued)

Proposed Content
Marking IV bottles and bags
Regulating an infusion rate
Making a piggyback connection
Dressing an intravenous site
Discontinuing an intravenous
Correcting common problems with IV equipment
Comparing and contrasting infusion machinery
Dealing with problems at the infusion site
Working with multiple intravenous lines
IV therapy and the pediatric patient
IV therapy and the intensive care patient
The effects of polyvinyl chloride administration sets on medications

The proposed list of content for the module was presented to the members of the practicum advisory panel who noted that the basics of fluid and electrolytes were introduced in the first year of the program. Since the subject will be covered in detail during the course following Transition, the advisory panel elected not to include the content in the intravenous module. The members of the advisory panel also noted that the students

were taught how to regulate the flow of an intravenous, the difference between a microdrip and macrodrip tubing, and, the effect of the needle lumen size on calculating the flow rate when they were given the formula for this skill in the first year. These items were deleted from the outline. In addition, first-year students were taught how to discontinue an intravenous infusion and how to apply a sterile dressing to an intravenous site. The members of the advisory panel decided that it was unnecessary to reteach these skills so these items were deleted.

The members of the practicum advisory panel indicated that it would be more appropriate to teach the specifics of the pediatric intravenous therapy during the Pediatrics Course and the specifics of intravenous therapy for the critically ill patient in the course where intensive care nursing is taught so these items were deleted. The members of the advisory panel felt that the effects of polyvinyl chloride on medications in intravenous administration sets is a highly technical subject not appropriate for an intravenous therapy module at this level. Table 2 shows the content that was deleted by the advisory panel from the list proposed for the Intravenous Therapy Module.

Table 2

Content Deleted from the Intravenous Therapy Module by the Advisory Panel

Content
Fluids and electrolytes
Regulating the infusion rate
Dressing an IV
Discontinuing an IV
IV therapy and the pediatric patient
IV therapy and the intensive care patient
The effects of polyvinyl chloride administration sets on medications

Several members of the practicum advisory panel felt that two topics should be added to the list of content for the Intravenous Therapy Module. The topics are IV credits, the calculation of the patient's intravenous fluid intake based on the amount left in the IV at the end of each shift, and practical math problems related to IV credits. After consulting with the remaining members of the advisory panel a consensus was reached and IV credits and math problems related to IV credits were added to the content of the module.

After the above changes were made, the members of the advisory panel accepted the list of content for the Intravenous Therapy Module. Table 3 shows the actual list of content.

Table 3

Content for the Intravenous Therapy Module

Content
Identifying common IV administration equipment
Setting up and maintaining primary and secondary lines
Setting up and maintaining volume-controlled sets
Adding medications to bottles and bags
Administering medications by way of a secondary line
Labeling bottles, bags and volume-controlled sets
Marking IV bottles and bags
Making a piggyback connection
Discontinuing an intravenous
Correcting common problems with IV equipment
Comparing and contrasting infusion machinery
Dealing with problems at the infusion site
Working with multiple intravenous lines
IV Credits
Math Problems related to IV Credits

Although the intravenous therapy module was designed to be a self-contained module it was to be taught in the Transition Course. In this course, six, three hour lab periods are available for the teaching and testing of skills. The first lab period is utilized for testing of first year skills and the last two lab periods are used for testing of second year skills. The members of the advisory panel agreed that the second, third, and fourth lab periods be used for teaching the Intravenous Therapy Module.

A review of student evaluations for Transition during the years 1983-1985 indicated that they felt there was a need for increased attention to intravenous therapy content in the program. In addition, the students requested that additional time be allotted for supervised practice of the skills required in mastering intravenous therapy.

With this information in hand, the members of the practicum advisory panel agreed that the focus of the second lab period will be teaching recognition of various types of intravenous therapy equipment and on setting up and maintaining intravenous equipment, including teacher supervised practice sessions. The focus of the third lab period will be correcting common problems with intravenous therapy equipment including teacher supervised practice sessions; and, comparing and contrasting infusion

machinery. The focus of the fourth lab period will be teacher supervised practice sessions in which content of the second and third lab period is reinforced and preparation for skills testing. The fifth and sixth lab period will be devoted to Intravenous Therapy Skill Assessment. Table 4 shows the focus of the content within the six lab periods in Transition.

Table 4

Focus of Lab Content Within the Six Lab Periods in Transition

Lab Period	
Lab 1	First Level Skill Testing
Lab 2	IV Equipment
	Setting up and Maintaining IV Equipment
	Teacher Supervised Practice
Lab 3	Correcting Common Problems with IV Equipment
	Teacher Supervised Practice
	Comparing and Contrasting Infusion Machinery
Lab 4	Teacher Supervised Practice
	Preparation for Skills Testing
Lab 5	IV Skill Testing
Lab 6	IV Skill Testing

Critical elements, defined as "single, discrete, observable, and mandatory behaviors that collectively comprise the standard against which an individual's competence is measured (Lenburg, 1979:47)" are used to define expected student behavior in the nursing program at Long Beach City College. A list of critical elements for intravenous therapy was prepared and presented to the members of the advisory panel. The critical elements were rewritten based on the input from the advisory panel. The revised list of critical elements were submitted to and approved by the advisory panel (Appendix B).

The labs to be completed in the second, third, and fourth weeks of the Transition Course were drafted.

Each lab contained critical elements, procedures, student responsibilities, teacher responsibilities, and assignments if applicable. The draft of the labs were given to the members of the practicum advisory committee. Members of the advisory panel indicated that it was redundant to present critical elements separately and as a part of the lab. Therefore, the critical elements were removed from the lab and the student was referred to the Critical Elements for Intravenous Therapy to be found in the Syllabus for Transition. The directions for the lab were then presented in the form of a procedure that the student could easily follow in completing the expectations

for the lab. Following the changes made by the committee, the labs were approved by the practicum advisory panel.

A worksheet for infusion machinery and sample problems for math related to IV credits were drafted and presented to the practicum advisory panel. Both were accepted as proposed to be included in the module.

The focus of the fifth and sixth lab was to be the assessment of IV therapy skills. A skill assessment sheet was prepared and presented to the members of the advisory panel for approval. Members of the practicum advisory panel suggested that the same sequence be followed, as nearly as possible, in the procedure listed for the lab and on the skill assessment sheet. These changes were made and the completed skill assessment sheet was approved. The Intravenous Therapy Module can be found in Appendix C.

In arranging the schedule, overall plan and equipment needed for each lab it was necessary to take into account the size of the class which is usually between fifty and sixty. In order to reduce the teacher/student ratio during the supervised practice in the second and third labs, these labs were each divided into two sections with approximately one-half of the students in each section. Three to four teachers will provide the supervision to the students who are practicing with the actual equipment while a single teacher provides

the materials best presented in a didactic manner and not requiring equipment except for demonstration. This format was presented to and approved by the members of the practicum advisory panel. The schedule, plan, and equipment needed for the labs can be found in Appendix D).

Chapter 5

DISCUSSION, IMPLICATIONS, AND RECOMMENDATIONS

Discussion

This practicum was completed to develop a formal intravenous therapy module to be utilized by the faculty to teach the principles of intravenous therapy to second year students enrolled in the registered nursing program at Long Beach City College. Intravenous therapy is a complex and exacting subject that requires a background of knowledge as well as the ability to problem solve and to take nursing action.

There is no question that intravenous therapy is an ever-increasing requirement of nursing practice. Fully one-quarter of all hospitalized patients and a growing number of home care patients require feeding by the intravenous route. Competent nursing care depends, in part, on the nurse being skillful in carrying out intravenous therapy in a safe and efficient manner.

Intravenous therapy includes many procedures that are inappropriate for the second year nursing student taking the Intravenous Therapy Module at Long Beach City College. The Parenteral Infusion Guidelines clearly spell out those procedures that are appropriate for the second

year nursing student and those that are not appropriate. The Parenteral Infusion Guidelines are included in the module materials as a reference for the student.

Following the review of the literature, it became apparent that limits must be placed on the amount of content to be included in the Intravenous Therapy Module. The members of the practicum advisory panel were helpful in identifying the content that should be included in the module and that which was better taught elsewhere. For example, fluids and electrolytes content is best covered in lecture. The focus of the Intravenous Therapy Module is on the skills needed to perform safe and effective intravenous therapy, and so, fluids and electrolytes is not included in the module. Content was also identified that had been taught in the first year of the program such as counting the drip rate and discontinuing the IV. The practicum advisory panel felt that it was important for the student to accept responsibility for this beginning level of skill, so this content was not included.

Because intravenous therapy is a complex subject requiring mastery of many skills it was felt that the laboratory setting is most appropriate for the module. Transition includes six, three hour lab periods and is perfect for this skill oriented lab module because of the availability of five of the six scheduled lab periods for the module.

The first lab period in Transition is reserved for the purpose of testing first-year skills. The Intravenous Therapy Module was designed to fit into the remaining five lab periods. These labs were designed to follow the department format of presenting materials from simple to complex. The focus of the second lab is on setting up intravenous therapy equipment. The focus of the third and fourth lab is on dealing with problems that occur in maintaining intravenous therapy equipment. In both the third and fourth labs, the student is required to set up the intravenous equipment before proceeding, thus reinforcing the procedure and skills required in the second lab.

Many nursing faculty members and previous students had expressed the need for increased teacher supervised practice during intravenous therapy content. The labs were designed for the students to work in pairs. Sufficient time is provided in the second, third and fourth labs for each student to run through the procedure at least once while the other student observes. During the second lab, the student observing can read the procedure to the student actually performing the skills. During the third and fourth labs, the student observing can time and critique the student who is doing the procedure according to the critical elements. The active participation of both students was planned as a reinforcer

which will assist them toward success on the intravenous skills test.

Dividing the class into two sections for the second and third labs will decrease the teacher/student ratio, so the teacher will be more available to answer questions and demonstrate skills as necessary. The smaller practice groups will reduce the noise and confusion levels in the lab and allow for more concentrated practice. The smaller size of the group participating in the lecture/discussion will also be beneficial in providing a positive atmosphere for discussion.

Critical elements were written to assist the student toward success during testing of intravenous skills. The critical elements identify single, discrete, observable, and mandatory behaviors that collectively comprise the standard against which the student's competence is measured when performing a skill. The students are familiar with critical elements and their usefulness in testing. Having the critical elements under a separate heading will provide the student with a reference to take to lab or to the clinical area.

The projected schedule, plan and equipment needed for the intravenous labs are included in the module. The schedule is based on a three hour block of time but could be adjusted as needed. The plan for the day follows the

specifications for the lab as designed for the module. The list of equipment given can be adjusted for the total number of students participating in the lab. These materials provide teachers new to Transition a means to carry out the Intravenous Therapy Module without undue stress.

The fact that learning is often facilitated by the use of a variety of teaching methods was emphasized in the literature. Many references were found to support the benefits of a self-paced audio-visual program to augment class presentations. Videotape presentations were found to be cost-effective in large populations and would therefore be a positive addition to the nursing program in teaching intravenous therapy. The advisory panel felt that it would not be feasible to include the preparation of such a videotape in this practicum but suggested that the development of an intravenous therapy videotape be considered for further study.

Implications

The results of this study provide a competency-based Intravenous Therapy Module that has clarified the boundaries of the subject, as delineated by members of the nursing faculty, as well as simplified the teaching and testing of intravenous therapy by the use of critical elements.

It is anticipated that the curriculum designed for the Intravenous Therapy Module will result in more effective teaching of the skills required in the administration of intravenous therapy. As a result of more effective teaching, the student will demonstrate increased proficiency in performing intravenous therapy skills in the lab. This will be demonstrated by an increase in the percentage of students passing the intravenous therapy skills assessment for the first time following completion of the module. The improvement will also indirectly improve our relationship with our clinical agencies who look for, and expect, proficiency in intravenous technique in our graduates.

Recommendations

Based upon the findings of this study, it is recommended that:

1. The Intravenous Therapy Module be placed in Transition for the fall semester of 1988.
2. The module be validated by comparing the success rate on the intravenous therapy skills assessment of students who have not taken the module and students who have taken the module.
3. The nursing faculty who teach Transition in the fall of 1988 evaluate the module to determine if the module is meeting faculty expectations.

4. Student evaluations for Transition include an area specific to the evaluation of the Intravenous Therapy Module to determine if the module is meeting student expectations.

5. The feasibility of developing a videocassette program specific to teaching intravenous therapy in the nursing program at Long Beach City College be investigated.

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APPENDIX A

PARENTERAL INFUSION GUIDELINES

Long Beach Community College District
LONG BEACH CITY COLLEGE
Division of Nursing and Health Technologies
Core Nursing Program/ADN

PARENTERAL INFUSION GUIDELINES

The following are the guidelines under which the ADN student at Long Beach City College will participate in parenteral infusion therapy.

I. Setting up intravenous infusions
   A. Set up intravenous equipment.
   B. Assist with the venipuncture (do not do venipunctures).

II. Assessing and Recording
   A. Record the solution, type and size of needle used, the anatomical location of the venipuncture and the name of the hospital personnel who started the IV, according to hospital policy.
   B. Record medication added to the solution.
   C. At 1-2 hour intervals assess and record information about the IV site indicating free flow or infiltration.
   D. Chart the IV intake on the intake and output record according to hospital policy.

III. Maintaining an infusion
   A. Maintain the infusion at the ordered rate.
   B. Check the infusion and site at least every hour.
   C. Add bottles/bags to ongoing infusions after checking IV orders.
   D. Correct an improperly functioning IV by the following measures:
      1. Check for infiltration
         a. Inspect needle/cannula site for signs of infiltration/inflammation.
         b. Palpate needle/cannula site for swelling or changes in temperature.
         c. Pinch tubing and release to check for blood return.
         d. Lower bottle to check for blood return if there is no backflow valve.
      2. Perform closed irrigation by wrapping the tubing around a pencil/finger.
      3. Increase pressure on needle/cannula by raising IV pole.
      4. Adjust needle angle and retape
      5. Notify RN if these measures do not produce freely flowing IV.

   F. Maintain infusion equipment according to agency policy.

IV. Adding Medications
   A. Add medications to bags, bottles, or volume-controlled sets according to hospital policy.
   B. Give medications via heparin lock. (RN must do the open irrigation before the hook-up and the heparin flush after the medication).

V. Discontinuing infusions
   A. Remove regular needles, butterflies (scalp veins), and plastic cannulas
   B. Do not remove arterial lines, or any IV that is sutured in place

VI. Adding Blood and Special Solutions
   A. Add blood under direct RN supervision, following hospital procedures.
   B. Add hyperalimentation, lipids, and alcohol solutions under direct RN supervision if permitted by hospital policy.

VII. Procedures prohibited for students.
   A. IV push medications of any kind
   B. Experimental drugs or chemotherapeutic agents
   C. Removal of any line that is sutured in place.
   D. Arterial irrigations including any intraflo device.
   E. Pulmonary wedge pressures.

Faculty/MB/1987

APPENDIX B

CRITICAL ELEMENTS FOR INTRAVENOUS THERAPY

Long Beach Community College District
LONG BEACH CITY COLLEGE
Division of Nursing and Health Technologies
Core Nursing Program/ADN

CRITICAL ELEMENTS FOR INTRAVENOUS THERAPY

Three areas of performance are identified as all-encompassing because they apply in every patient care situation. These areas of performance are labeled Comprehensive Skills and will be evaluated each time care is given.

COMPREHENSIVE SKILLS

Long Beach City College nursing students will:

I. Provide safety for the patient including freedom from physical and psychological harm and good aseptic technique.
II. Demonstrate satisfactory communication and interpersonal relationships.
III. Follow the nursing process including making assessments and nursing diagnoses, planning and prioritizing nursing care before it is given and evaluating and recording care after it is given.

Critical elements are the essential parts of a skill that must be performed every time the skill is performed. The specific critical elements for intravenous therapy skills are listed below.

I. SETTING UP AN IV
   A. Use designated equipment.
   B. Clear air from tubing before initiating flow (any break in the fluid column constitutes air in the line).
   C. Regulate flow as ordered.

II. ADDING MEDICATION TO AN IV BOTTLE/BAG
   A. Use designated equipment
   B. Observe the five rights when preparing medications
   C. Label the bottle/bag to show medication added.
   D. Record medication on the appropriate form.

III. MARKING AN IV BOTTLE/BAG TO SHOW THE AMOUNT TO BE INFUSED PER HOUR
   A. Mark the bottle/bag while inverted to indicate ordered amount of fluid to be delivered in specified period of time.

IV. SETTING UP AND ESTABLISHING A SECONDARY LINE
   A. Use designated equipment.
   B. Clear air from tubing before initiating flow
   C. Make the piggyback connection into appropriate port of the primary line.

V. SETTING UP A VOLUME-CONTROLLED ADMINISTRATION SET
   A. Use designated equipment
   B. Drop designated amount of solution into the chamber and clear tubing with not more than 10 ml of fluid remaining in the chamber.
   C. Establish airway in chamber to maintain designated flow rate.

VI. ADDING MEDICATION TO A VOLUME-CONTROLLED ADMINISTRATION SET
   A. Use designated equipment.
   B. Observe the five rights when preparing medications.
   C. Administer or regulate flow to deliver the correct amount in the correct period of time.
   D. Label chamber to show medication in solution.
   E. Record medication on medication sheet.

VII. CORRECTING AN IV THAT IS NOT INFUSING
   A. Begin one of the corrective actions listed in the Parenteral Infusion Guidelines within two minutes after the IV stops infusing.
   B. If corrective actions are not successful within one minute call for assistance.
   C. If corrective actions are successful, readjust rate to deliver flow ordered.

VIII. CORRECTING FOR TOO LITTLE FLUID IN A DRIP CHAMBER
   A. Prevent air from entering the line.
   B. Fill the drip chamber to level marked on the drip chamber.

IX. CORRECTING FOR TOO MUCH FLUID IN THE DRIP CHAMBER
   A. Displace fluid into bottle/bag without allowing air to enter the line.

X. CORRECTING FOR TOO MUCH FLUID IN THE CHAMBER OF A VOLUME-CONTROLLED ADMINISTRATION SET
   A. Displace fluid into bottle/bag keeping the filter dry and the tubing free of air.
   B. Readjust rate to deliver ordered amount of solution.

XI. CORRECTING FOR A CLOSED DIAPHRAGM ON AN ABBOTT VOLUME-CONTROLLED ADMINISTRATION SET
   A. Open diaphragm without wetting filter.
   B. Prevent air from entering line.
   C. Readjust rate to deliver ordered amount of solution.

XII. REMOVING AIR FROM AN IV LINE
   A. Prevent air from infusing into the patient.
   B. Remove air from tubing using a syringe and needle
   C. Prevent occlusion of the needle/cannula during procedure
   D. Readjust rate to deliver ordered amount of solution.

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APPENDIX C

INTRAVENOUS THERAPY MODULE

Long Beach Community College District
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Division of Nursing and Health Technologies
Core Nursing Program/ADN

INTRAVENOUS THERAPY MODULE

MODULE OVERVIEW

The Intravenous Therapy Module is a skills oriented module designed to provide the student practical knowledge and skill in working with intravenous equipment. Emphasis is placed on assisting the student to master the technical skills involved in infusion therapy. The student will be provided supervised practice with infusion equipment in the lab and in the clinical setting.

MODULE CONTENT

1. Identifying common IV administration equipment
2. Setting up and maintaining primary and secondary lines
3. Setting up and maintaining volume-controlled sets
4. Adding medications to bottles and bags
5. Administering medications by way of a secondary line
6. Labeling bottles, bags and volume-controlled sets
7. Marking IV bottles and bags
8. Making a piggy back connection
9. Discontinuing an intravenous
10. Correcting common problems with IV equipment
11. Comparing and contrasting infusion machinery
12. Dealing with problems at the infusion site
13. Working with multiple intravenous lines
14. IV credits
15. Math problems related to IV credits

STATEMENT OF PURPOSE

After completion of the Intravenous Therapy Module, the student will provide safe and effective infusion therapy to hospitalized patients under the direct supervision of a registered nurse.

TIME ALLOTMENT

Campus Lab: 3 hours per week for five weeks

REQUIREMENTS OF THE MODULE

Lab participation
Learning Center assignments
Successful completion of the Assessment of IV Therapy Skills
Adherence to all Departmental policies
Adherence to the Parenteral Infusion Guidelines
Adherence to the Critical Elements for Intravenous Therapy

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Division of Nursing and Health Technologies
Core Nursing Program/ADN

SKILL LAB 2: INTRAVENOUS THERAPY - SETTING UP

DIRECTIONS
Working with a partner and the intravenous equipment provided in the lab setting, follow the procedure for setting up as directed below. Time has been provided for each student to complete the procedure at least once.

CRITICAL ELEMENTS
All critical elements for intravenous therapy appropriate to this lab are applicable.

PROCEDURE

A. Set Up a Primary Line.
   1. Add a "medication" to a 500 ml IV bottle of saline.
   2. Label the bottle to show the medication, amount, time, date, and your initials.
   3. Using a 500 ml bottle of saline and a macrodrip administration set, set up a primary line.
   4. Purge the air from the tubing before initiating the flow (any break in the column of fluid constitutes air in the line).
   5. Once line has been purged of air, tape the patient end of the tubing into basin provided to indicate that the IV has been started.
   6. Regulate the flow to 20 gtts/minute. The primary line must be infusing at all times to prevent occlusion of line.
   7. Mark the bottle while it is inverted to indicate the specified amount of fluid to be delivered in the specified period of time.

B. Set Up a Secondary Line Using a Volume-Controlled Administration Set.
   1. Using a volume-controlled administration set (Solu-Set) and a 500 ml bottle of saline, set up a secondary line.
   2. Drop approximately 20 ml of solution into the Solu-Set.
   3. Attach a sterile needle to the volume-controlled administration set.
   4. Open the air vent in Solu-Set to allow for adequate flow of fluid.
   5. Purge the air from the line and needle.
   6. Make the piggyback connection of Solu-Set line into the primary line using the port closest to the patient.
   7. Instill a "medication" into the Solu-Set.

8. Label the Solu-Set to show that a "medication" has been added.
9. Regulate the Solu-Set to 40 mcgtt/minute.

C. Set Up a Secondary Line Using Short Secondary Administration Set.
1. Using a short secondary administration set and a 150 ml bottle, set up a secondary line by backfilling from the primary line.
2. Make the piggyback connection of the secondary line into the port just below the bottle of the primary line.
3. Purge the air from the secondary line by lowering the secondary bottle and opening the slide clamp on the secondary line (this will allow the fluid from the primary line to flow backward into the secondary line). Allow the line to fill until the drip chamber of the secondary line is partially filled.
4. Regulate the flow of the secondary line to 20 gtts/minute.

STUDENT RESPONSIBILITIES
1. Prior to the, lab review all first year materials on IV therapy.
2. Prior to the lab, view the Intravenous Therapy Videocassette.
3. Perform the steps in lab procedure in the lab at least once.
4. Practice independently or with requested teacher assistance in preparation for assessment of intravenous therapy skillS
5. Learn the Parenteral Infusion Guidelines

TEACHER RESPONSIBILITIES
1. Provide the equipment for practice as needed by students
2. Demonstrate each step of the procedure and observe the return demonstration of each student.
3. Be available to answer questions and provide assistance as needed.

ASSIGNMENTS
Text: Brunner pp 131-138
Learning Center: Videocassette on Intravenous Therapy
Syllabus: Critical Elements
Parenteral Infusion Guidelines

TESTING
Intravenous Therapy skills will be tested in an on-campus return demonstration. The student will be tested according to the critical elements with 100% accuracy expected. Testing must be completed within a twenty minute time period. Nursing Department Policy will be followed for all skills testing.

Long Beach Community College District
LONG BEACH CITY COLLEGE
Division of Nursing and Health Technologies
Core Nursing Program/ADN

SKILL LAB 3: CORRECTING COMMON PROBLEMS WITH INTRAVENOUS THERAPY EQUIPMENT

DIRECTIONS
Working with a partner and the intravenous equipment provided in the lab setting, follow the procedure listed below. The "problems" to be corrected are to be created by the student and/or by the instructor. Time has been provided for each student to complete the procedure at least once.

CRITICAL ELEMENTS
All critical elements for intravenous therapy appropriate to this lab are applicable.

PROCEDURE

A. Set Up Intravenous Equipment
   1. Using a 500 ml bottle and a macrodrip administration set, set up a primary line.
   2. Using a 500 ml bottle and a volume-controlled administration set (Solu-Set), set up secondary line.
   3. Piggyback the secondary line into the primary line using the port closest to the patient.
   4. Regulate both IVs to 20 gtts/minute.

B. Correct Common Problems.
   1. Primary line not infusing.
   2. Secondary line not infusing
   3. Too little fluid in the drip chamber of the primary line.
   4. Too little fluid in the drip chamber of the secondary line.
   5. Too much fluid in the drip chamber of the primary line
   6. Too much fluid in the drip chamber of the secondary line.
   7. Too much fluid in the chamber of the volume-controlled administration set
   8. Air in line of primary administration set.
   9. Air in line of secondary administration set.

STUDENT RESPONSIBILITIES
1. Review the Intravenous Therapy Videocassette prior to lab
2. Review the procedure for setting up intravenous equipment from the Skill Lab 2 prior to the lab.
3. Complete the Infusion Equipment Worksheet prior to lab
4. Complete the math problems related to IV credits prior to the lab.
5. Perform the steps in the procedure in lab at least once.

Skill Lab 3: Correcting Common Problems with Intravenous Therapy Equipment (Cont'd)

6. Observe and critique your partner while he/she performs the procedures.
7. Practice independently or with requested teacher assistance in preparation for assessment of intravenous therapy skill.

TEACHER RESPONSIBILITIES

1. Provide the equipment for practice as needed by students
2. Demonstrate each step of the procedure and observe the return demonstration of each student.
3. Create problems with the IV equipment for the students to correct.
4. Be available to answer questions and provide assistance as needed.

ASSIGNMENTS

Text: Review Brunner pp 131-138
Learning Center: Review the Videocassette on IV Therapy
Syllabus: Critical Elements
Infusion Machinery Worksheet
Parenteral Infusion Guidelines
Articles: "Too Fast or Too Slow: The Erratic I.V.", AJN June 1983
"Whats on the Market? A Nurses's Guide," AJN June 1983

TESTING

Intravenous Therapy Skills will be tested in an on-campus return demonstration. The student will be tested according to the critical elements with 100% accuracy expected. Testing of intravenous therapy procedures must be completed within a twenty minute time period. Nursing Department Policy will be followed for all skills testing.

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LONG BEACH CITY COLLEGE
Division of Nursing and Health Technologies
Core Nursing Program/ADN

SKILL LAB 4: INTRAVENOUS THERAPY - SUPERVISED PRACTICE AND PREPARATION FOR TESTING

DIRECTIONS
Working with a partner and the intravenous equipment provided in the lab setting, follow the procedures from Skill Labs 2 and 3 for setting up intravenous equipment and correcting common problems respectively. Time has been provided for each student to complete the procedure at least once. The procedure should be timed to prepare the student for the 20 minute time limit for testing.

CRITICAL ELEMENTS
All critical elements for intravenous therapy appropriate to this lab are applicable.

PROCEDURE
1. Set up a primary line and both types of secondary lines.
2. Create and correct common problems with intravenous equipment.

STUDENT RESPONSIBILITIES
1. Prior to the lab, review all intravenous therapy materials as necessary.
2. Prior to the lab, review the Intravenous Therapy Videocassette as necessary.
3. Perform the procedures at least once in the lab.
4. Observe, time and critique your partner while he/she performs the procedures.
5. Observe the teacher demonstration of the testing procedure.
6. Practice independently or with requested teacher assistance in preparation for the assessment of intravenous therapy skills.

TEACHER RESPONSIBILITIES
1. Provide the equipment for practice as needed by the students.
2. Be available to answer questions and provide assistance as needed.
3. Demonstrate testing as it will be done in the Skill Assessment Lab.

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LONG BEACH CITY COLLEGE
Division of Nursing and Health Technologies
Core Nursing Program/ADN

SKILL LABS 5 AND 6: ASSESSMENT OF IV THERAPY SKILLS

Name_____ Date_____

Evaluator_____Start_____ End_____

DIRECTIONS
Working independently, complete the intravenous skill assessment within 20 minutes.

CRITICAL ELEMENTS
All critical elements for intravenous therapy are appropriate to this skill assessment and must be met with 100% accuracy.

PROCEDURE	Pass	Fail	Comments
Set up primary IV administration set			
Label bottle for ml/hr			
Set up Solu-Set administration set			
Piggyback Solu-Set line into the primary IV line			
Add medication to Solu-Set and label			
Correct at least two common problems			
IV not infusing			
Too little fluid in the drip chamber			
Too much fluid in the drip chamber			
Too much fluid in the Solu-Set			
Solu-Set diaphragm closed			
Air in line			
Set up short secondary line by backfilling from primary line			
Complete I.V. Skills Assessment within 20 minutes			

Nursing Department Policy will be followed for all skill testing.

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Division of Nursing and Health Technologies
Core Nursing Program/ADN

INFUSION MACHINERY WORKSHEET

Source: "What's on the Market? A Nurse's Guide" AJN June 1983
"Setting Up and Troubleshooting" AJN July 1983

1. Describe the difference between a controller and a pump

2. Define the following terms

   Volumetric

   Nonvolumetric

3. Which of the above is considered to be more accurate? Why?

4. Peristaltic, piston-cylinder and piston-diaphragm are terms that refer to the controlling mechanisms of pumps. Briefly describe how each works and give an example of each

   peristaltic

   piston-cylinder

   piston-diaphragm

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Division of Nursing and Health Technologies
Core Nursing/ADN Program

IV PROBLEMS

Information/Directions:
Intake and output is done at 0630 and 1430
Do calculations for both Abbott and Travenol.
Calculate the ordered rate in gtts/min
Calculate the actual rate in gtts/min
Make the decision to speed up/slow down or just watch the IV

1. During report, the night nurse says that there is 800 ml left in the IV as of 0630, and that you are to take credit for 800 ml. The IV is to run until 1430. When you enter the room at 0730, you see there is 550 ml left in the bag. How fast will you run the IV for the rest of your shift?
   a. ordered rate
   b. actual rate
   c. decision

2. During report, the night nurse says that there is 1000 ml left in the IV, as of 0630, and that you are to take credit the full 1000. The IV is ordered to run at 125 ml per hour. When you enter the room at 0800 you see that there is 400 ml left in the bag. How fast will you run the IV for the rest of your shift?
   a. ordered rate
   b. actual rate
   c. decision

3. During shift report, the night nurse says that there is 900 ml left in the IV as of 0630. You are to take credit for that amount. The IV is to run until 1430. When you enter the room at 0730 you see that there is 1000 left in the bag. How fast will you run the IV for the rest of your shift?
   a. ordered rate
   b. actual rate
   c. decision

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APPENDIX D

SCHEDULE, PLAN AND EQUIPMENT NEEDED FOR THE INTRAVENOUS THERAPY LABS

Long Beach community college District
LONG BEACH CITY COLLEGE
Division of Nursing and Health Technologies
Core Nursing Program/ADN

Campus Lab 2: Intravenous Therapy - Setting Up
Schedule, Plan and Equipment Needed for Lab

Rooms 300/303/302

Schedule (3 hours)

0900-0920	Introduction, schedule, etc. Division of student group for practice
0920-1020	Section I - Practice setting up IVs following procedure on Skill Lab 2 (4 teachers - approximately 1/2 the class) Section II Discussion (1 teacher - approximately 1/2 the class) 1. Responsibilities with infusion therapy 2. IV "credits" 3. Demo of equipment with reasons 4. Parenteral Infusion Guidelines 5. Critical Elements
1020-1050	BREAK
1050-1150	Reverse groups

Directions to students the week/day before the lab

1. View videotape on IV Therapy prior to lab
2. Meet in room 302
3. Bring Critical Elements, Parenteral Infusion Guidelines to lab
4. Review Skill Assessment sheet
5. Dress according to Department Policy for Lab attire. Wear name tag.

Directions to supply clerk

Set up 19 stations (depends on number of students in class)
1 in room 302 for demonstration
9 in room 303
9 in room 300

Equipment at each station

IV pole
2 500cc bottles
1 Solu-Set
2 primary lines
1 secondary line
emesis basis
syringe and needle
Needle without syringe
vial of normal saline
alcohol wipes
masking tape
marking pen
100 cc partial fill bottle

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Division of Nursing and Health Technologies
Core Nursing Program/adn

Campus Lab 3: Intravenous Therapy - Problems
Schedule, Plan and Equipment Needed for Lab

Rooms 302/303/300

Schedule (3 hours)

0900-0910	Introduction, schedule, etc. Division of student group for practice
0910-1010	Section II - Set up equipment and practice correcting common problems following procedure on Skill Lab 3 (4 teachers-approximately 1/2 the class) Section I - Discussion (1 teacher-approximately 1/2 the class) 1. Problems with equipment with reasons problems occur and solutions work 2. Demonstration of testing situation 3. Sign up for testing 4. Infusion Machinery Worksheet 5. Math problems related to IV credits
1010-1040	BREAK
1040-1150	Reverse

Directions to students

1. Prior to lab, review video as necessary.
2. Meet in room 302
3. Bring completed math problems
4. Review Skill Assessment Lab, Parenteral Infusion Guidelines and Critical Elements.
5. Dress according to Department Policy with name tag.

Directions to supply clerk

Equipment needed

Same as for IV Lab 2 with the addition of the IVAC for demonstration in room 302

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Division of Nursing and Health Technologies
Core Nursing Program/ADN

Campus Lab 4: Supervised Practice and Preparation for Testing
Schedule, Plan and Equipment Needed for Lab

Rooms 300/302/303 and workroom

Schedule (3 hours)

0900-1020	Practice with clinical group Demonstrate testing (4 teachers/entire class)
1020-1050	Break
1050-1150	Continue as above

Directions to supply clerk

Set up 25 stations (50 students) divided equally among the rooms available.

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LONG BEACH CITY COLLEGE
Division of Nursing and Health Technologies
Core Nursing Program/ADN

Campus Labs 5 and 6: Assessment of IV Therapy Skills
Schedule, Plan and Equipment Needed for Lab

Rooms 300/303/302/Workroom

Schedule 0900-1200
Testing by each clinical teacher
Students to be tested in pairs at 20 minute (maximum) intervals.

<u>Directions to supply clerk</u>
Supplies needed for lab
Please put equipment for each instructor on a separate cart.
6 new set-ups for each of 4 clinical teachers

2 500cc botles	Needle without syringe
1 soluset	vial of normal saline
1 primary line	alcohol wipes
1 secondary line	marking pen
emesis basin	masking tape
syringe and needle	100 cc partial fill bottle

2 IV poles for each teacher
Extra alcohol wipes
Supply of paper towels